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## LETTERS TO THE EDITOR

# Silica with Grafted Photolabile Groups

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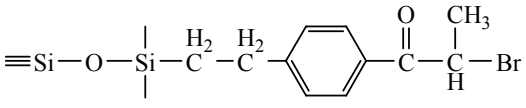
In recent years silica carriers are increasingly frequently applied for the address delivery of drugs [1, 2]. It is necessary to note that such compounds are fixed on the silica surface by chemical bonds of various nature, thus the important stage is splitting off pharmaceuticals by means of physical or chemical methods.

In this work we have shown the basic possibility of photochemical splitting off organic compounds when silica is used as the carrier for address delivery of drugs. For this purpose we have synthesized a model peptide BOC-glycylglycine on silica with application of photolabile α-methylphenacyl anchor bonds.

According to the technique [3], in the first stage of the synthesis we have obtained grafted α-methylphenacyl anchor groups **1,** centers of chemisorption of amino acids, by means of 2-phenyl-ethyltrichlorosilane chemisorption on the silica carrier surface followed by the acylation of grafted groups by α-bromopropionic acid chloride (Friedel–Crafts reaction).



**1**

As the initial carrier we used macroporous Silochrom silica with following structural characteristics: the specific surface area of 160±7 $m^2/g$, the most probable effective porous radius of 12 nm, and the pore volume of 1.68 $cm^3/g$. According to the elemental analysis, the concentration of the grafted groups was 0.45±0.02 mmol/g.

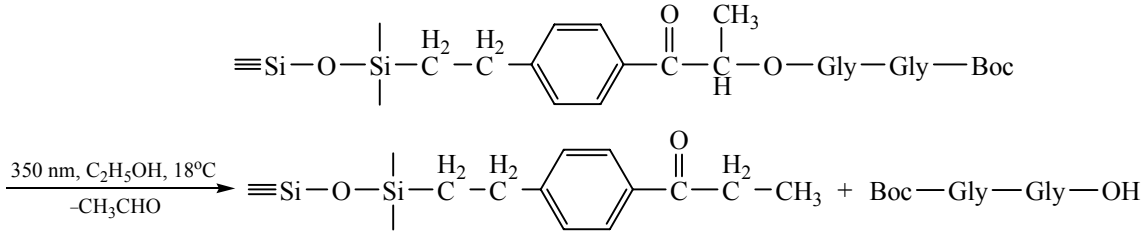
The chemisorption of BOC-glycine on resulting grafted anchor groups was carried out according to the technique [4] including nucleophilic bromine replacement with application of a cesium salt of a protected amino acid. The concentration of chemisorbed glycine (0.14 mmol/g) was determined by the analysis for the content of free amino-groups using acid bright orange Zh dye by the technique [5].

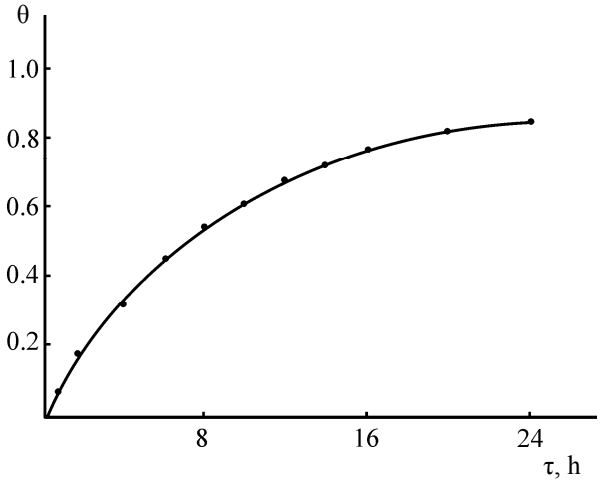
The structure of the grafted organic groups was confirmed by IR spectroscopy. The IR spectrum of silica with grafted glycine contains both the absorption bands characteristic for α-methylphenacyl anchor groups grafted to the silica surface (1685, 1580, 1500, and 1450 $cm^{-1}$) [3] and the absorption band of the C=O double bond stretching vibration in esters (1740 $cm^{-1}$) [6], which confirms the chemisorption of the amino acids on the anchor groups with the formation of the ester bond.

The second amino acid residue was attached by the known technique by means of dicyclohexylcarbodiimide [7], using the fivefold molar excess of the reagent and BOC-glycine in relation to free amino groups. In such conditions all amino groups enter the acylation reaction, which is confirmed by the chemical analysis data.

In this work, to split off obtained dipeptide from the carrier, we used photochemical cleavage of the ester bond under the sample irradiation by the light with the wavelength of about 350 nm. The photolysis is possible, as the phenacyl group has a low-lying excited state, therefore, as was shown in [8], the ester bond can be split off to form free radicals, which are saturated

**Scheme 1.**




Dependence of the degree of dipeptide splitting off on the irradiation time.

due to the solvent oxidation. In our case the process is likely to proceed according to the Scheme 1.

To carry out the photochemical cleavage, samples of silochrome with grafted dipeptide (70 mg) were placed in pyrex glass ampules and blown through by dry argon, then ethanol was added and the ampules were irradiated with a DRL-400 high-pressure mercury lamp. The samples were continuously cooled by flowing water, and the hard radiation with wavelength less than 320 nm was filtered out by a copper sulfate aqueous solution. The degree θ of peptide splitting off from the carrier was determined by the analysis for the content of free amino groups. Dipeptide removed from the carrier after filtering and evaporation was crystalized from the (1 : 1) ethylacetate–petroleum ether mixture and identified by the melting point (135°C [9]), elemental analysis data, and thin-layer chromatography. The dependence of the degree of dipeptide splitting off on the irradiation time is presented in the figure.

As a whole, the results presented in this work confirm the basic possibility of soft photolytic splitting off from the silica carrier peptides used as spacers for the immobilization of biologically active compounds.

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